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ABSTRACT

A study empirically examined a high school career academy's influence on entrance into, route through, and outcomes upon exiting a four-year comprehensive, urban university in California. Data are drawn from applicant and student records for all students coming from a single high school district that has a strong career academy program. Findings suggest that students from career academies have higher academic achievement upon leaving high school, less need for remediation in English at the university, and increased graduation rates from the university than students who are not from academies. Unfortunately for students from this district, the high rates of remediation and the low rates of graduation suggest that the impact of the career academy may not be enough to ensure success in postsecondary education. About 70 percent of the applicants from the district need some type of remediation, and about 45 percent need remediation in both mathematics and English. Only about half of those who enroll in the university actually graduate. Unless high school school-to-work programs dramatically improve these percentages for students from inner-city schools, students will continue to struggle at the university level and beyond. (Contains 16 references.) (KC)

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National Center for Research in Vocational Education

University of California, Berkeley

Step to College

Moving from the High School Career Academy Through the Four-Year University

Nan L. Maxwell
Human Investment Research and Education Center
California State University, Hayward

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Executive Summary

This study empirically examines the high school career academy's influence on entrance into, route through, and outcomes upon exiting a four-year university. Data is drawn from applicant and student records at a comprehensive, urban university for all individuals originating from a single high school district that has a strong career academy program. Our findings suggest that students from career academies have higher academic achievement upon leaving high school, less need for remediation in English at the university, and increased graduation rates from the university than students who are not from academies. Unfortunately, the high rates of remediation for students from this district and the low rates of graduation suggest that the impact of the career academy may not be enough to ensure success in postsecondary education. About 70% of the applicants from this district need some type of remediation, and about 45% need remediation in both math and English. Only about half of those who enroll in the university graduate. Unless high school school-to-work programs can *dramatically* improve on these percentages for students from inner city schools, students will continue to struggle at the university level and beyond.

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Introduction

Criticism abounds about our public schools. Businesses tell secondary and postsecondary schools that their students enter the labor market unprepared to meet the challenges posed by a knowledge-based society. University faculty complain about the low level of academic knowledge that students bring to campus. The popular press reports that academic achievement of U.S. students is low in international comparisons. Proposed solutions to "fixing" our schools may be more abundant than criticisms leveled their way, with consensus about reforms arguably existing only with respect to high standards for success, low expectations of their realization, and a quest for a one-size-fits-all magic bullet. The consequence is that reforms are quickly embraced, partially implemented, and quickly discarded.

It is within this environment that high schools in particular began to blur the distinction between vocational and academic curriculum within an occupational focus as a way of increasing the quality of education.[1] Advocates of these "school-to-work" programs do not see them as simply revamping traditional vocational education or as limited to students who would otherwise be in those programs. In fact, many programs emphasize the connections between high school and community college, and many are designed to maintain university attendance as an option for students. School-to-work programs seek to develop academic skills for *all* segments of the student population.

Because many school-to-work programs originated during the late 1980s and 1990s with relatively large-scale efforts not realized until the mid 1990s, they have not been afforded the benefit of extensive longitudinal analysis of outcomes. As a result, the long-term consequences of the reforms are unknown. This paper is one attempt to assess the longer-term impact of the high school career academy, one type of school-to-work program, by comparing the postsecondary educational outcomes of students from academies and students from the same high school district who were not in career academies. Using student-level data from an urban, comprehensive university in California, our analysis suggests that career academies raise

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[1] These efforts were codified in two pieces of national legislation: the Carl D. Perkins Vocational and Applied Technology Education Act of 1990 (Perkins II) and the School-to-Work Opportunity Act of 1994 (STWOA). Perkins II reestablished the commitment to high quality occupational education in high school and expanded the role that postsecondary institutions, particularly community colleges, played in curriculum development (e.g., see Office of Educational Research and Improvement, 1994). The STWOA reestablished the need for high academic standards and integrating workplace knowledge and skills into the academic curriculum.

students' GPAs in high school, lower the need for remediation in English at the university, and increase the probability of graduating from the university. However, students from this district face high rates of remediation before college-level coursework can begin and low rates of graduation, suggesting that the marginal impact of the academy program may not be strong enough to ensure postsecondary educational success for inner city students. Unless students' knowledge and skills can be increased to levels at which students enter the four-year university ready to complete college-level coursework, school-to-work reform efforts will remain one small improvement in a system that needs large-scale change.

Framework

Within school-to-work programs, the career academy is arguably the most well-developed model. The career academy builds a "school-within-a-school" and coordinates curriculum and activities around a single occupation, profession, or industry that is in demand in the local labor market. Core academic subjects are integrated with vocational/technical laboratory courses and emphasize the relationship between academics and the workplace. Although students do not earn formal occupational skill credentials, they often work in the industry of focus during the summer after their junior year. Employers are actively involved in building curriculum and in donating time as mentors and workplace supervisors (e.g., Stern, Raby, & Dayton, 1992). Research on career academy programs illustrates their effectiveness (e.g., Kemple, 1997; Kemple & Rock, 1996), including their ability to reduce high school dropout rates (Stern, Dayton, Paik, Weisberg, & Evans, 1988), improve job performance and work attendance (e.g., Linnehan, 1996), and increase academic knowledge and skills taken from high schools and the probability of attending postsecondary universities (Maxwell & Rubin, forthcoming).

Career academies have not yet been the explicit focus of research efforts that examine postsecondary educational *outcomes*. Instead, Technical Preparation (Tech Prep) programs are usually used to illustrate school-to-work links between postsecondary institutions and high schools.[2] By programmatically connecting high school and two years of college for an associate's degree (2+2 program), Tech Prep programs open postsecondary to groups who traditionally truncate education in high school. While this approach is often seen as a positive influence for the noncollege-bound students, it is often viewed with skepticism for the traditionally college-bound students. In fact, some parents, teachers, employers, and college admission personnel remain dubious about the potential of any school-to-work program to prepare students for college (e.g., Public Agenda, 1996) because its core curriculum links education and practice through "applied academics," integrated curriculum, and career-focused coursework. Research is used to support this skepticism by arguing that the positive relationship between *academic* coursework and postsecondary education arises because of its advanced academic content (e.g., Altonji, 1995).

Supporters of school-to-work programs refute these conclusions with pedagogical arguments illustrating the strength of applied teaching (e.g., Bailey & Merritt, 1997) in providing an authentic learning environment that motivates *all* students to learn and to pursue additional education. Because the value of education and lifelong learning in a knowledge-based

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[2] See Bragg (1995, 1999) for a discussion.

labor market is viewed as a necessity for all students, school-to-work programs can improve learning outcomes for *all* students, including those in college preparation programs. Proponents of school-to-work programs also suggest that traditional college preparation programs often leave students unprepared for college-level work, as evidenced by the high rates of remediation before college-level coursework can begin. If school-to-work pedagogies can succeed where college preparation programs fail, in terms of providing academic knowledge and skills, it is institutional constraints that inhibit school-to-work programs from becoming programs leading to university enrollment (e.g., McCormick, Alt, & Geis, 1998).[3] These potential institutional constraints suggest that the potential for successfully articulating students from school-to-work programs to postsecondary education may be through a local postsecondary institution that is familiar with local high school programs. In fact, the local university could develop ties with the high school in such a way that the students' needs for postsecondary education are met as they leave high school and throughout work life.

We examine the potential for school-to-work programs, as embodied by career academies, to facilitate postsecondary education using a unique data set containing data from a local four-year university for individuals from a single high school district.[4] Because nearly one-quarter of the district's applicants to the university were former career academy students, we are able to compare career academy students with their nonacademy counterparts with respect to preparing for entrance into, the route through, and exit from the university.

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[3] Either academic snobbery within the university against "applied learning" or the use of screens—academic preparation programs—to control applicant flow would prevent school-to-work programs from placing students into the university.

[4] The university draws about 80% of its students from a two-county region, it has worked closely with this particular school district on its career academy programs.

Empirical Framework

We examine the postsecondary educational outcomes and activities of individuals from a single school district who applied to the local university from 1990 to 1998 for a degree program.[5] We are interested in observing the career academy's influence on each successive step through the university: entrance into, route through, and exit from. By examining the academy's influence on the progression through each step, we can determine the points at which it helps students through college and the points at which it has no influence. It may be at the latter points that other interventions are needed.

We first assess the academy's influence on entrance into college as measured by acceptance to and enrollment in the university. This analysis answers the questions "Does the career academy help students gain admission to a four-year university?" and "Does it help ensure that students enroll once admitted?" We then assess the academy's influence on the route taken through college by examining the need for remediation and the transfer status of students. Undertaking remediation and transferring to the university, usually from the community college, often lengthen the time to degree for students. This analysis answers the question, "Does the career academy help the student move through the university in a timely manner?" Finally, we examine the academy's influence on the student's exit from the university as measured by dropping out, academic dismissal, and graduating and by the student's academic achievement at exit (GPA).[6] This analysis answers the question "Does the academy facilitate positive postsecondary educational outcomes for its students?"

We empirically model a student's entrance into the university as a function of career academy enrollment, individual demographics, high school of origin, and academic preparation.[7] However, because the career

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[5] We did not include individuals who applied to or attended the university on a temporary basis. Most of these individuals were high school students taking courses at the university.

[6] GPA is an extremely crude measure of achievement at the university when program differentiation imparts different levels of knowledge and skills and programs use different measures of "rigor" in assessment (e.g., Young, 1990; Elliot & Strenta, 1988). We examined the distributional differences between college majors of academy and nonacademy students and found that few differences existed between those who declared a major. However, far fewer academy students (71%) than nonacademy students (83%) declared a major.

[7] It could be argued that demographic characteristics and high school of origin only influence acceptance to and enrollment in the university through academic preparation and not as an independent influence. However, the university in our study has a high percentage of students who do not meet university admission requirements ("special admits") but are admitted for special reasons. In this sample,

academy could have both a direct and indirect (through academic achievements in high school) effects on entrance into college, we first model achievement in high school, as proxied by high school grade point average[8] as a function of career academy enrollment such that

1. $hsgpa = \alpha_{1,0} + \alpha_{1,1}academy + \alpha_{1,i}\Sigma demo + \alpha_{1,j}\Sigma hs$
   where

   - hsgpa = the student's grade point average in high school
   - academy = a binary variable indicating enrollment in a career academy in high school
   - demo = a vector of demographic characteristics of the student
   - hs = a vector of variables designating the student's high school.

   Appendix A fully defines all variables.

Equation 1 models the influence of the career academy on academic knowledge and skills taken from high school, holding constant individual characteristics and high school of origin.[9] We note that data limitations preclude us for controlling for *individual* socioeconomic background factors in this estimation. However, high school of origin and demographic characteristics are closely associated with socioeconomic status and, as we will see, may serve as their proxy. If $\alpha_{1,1} > 0$, results of the estimation suggest that the career academy increases academic achievement in high school. If $\alpha_{1,1} < 0$, results of the estimation suggest that the career academy reduces academic achievement in high school. If $\alpha_{1,1} = 0$, we cannot reject the null hypothesis that the career academy has no influence on academic achievement in high school. Since GPA is a relatively unbounded,

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the admission is primarily based on a disadvantaged background. Thus, individual characteristics and high school of origin, both of which are correlated with socioeconomic background, are independent predictors of admission and enrollment.

[8] We recognize that GPA is a suspect measure of academic preparation for college for a number of reasons, including variability in its anchor points and inaccuracies in reporting. However, because students in our analysis have GPAs that originate within a single high school district, the variability in standards is less than if the GPA originated in different districts. Also, because we derive both high school and university GPA data from transcripts, we are less likely to report an upward bias (Wobegon effect) in its measure (Maxwell & Lopus, 1994).

[9] Of course, if different grading exists between academy and nonacademy courses, GPA differentials would merely reflect different grading standards. However, analysis along these lines suggests that this is not the case for academies in this district (Maxwell & Rubin, forthcoming).

continuous measure, we estimate Equation 1 with Ordinary Least Squares regression analysis (OLS).

We next model the individual's probability of being accepted to and enrolling in the university[10] as a function of being in a career academy, academic preparation, demographics, and high school of origin such that

2. $\text{entrance} = \alpha_{2,0} + \alpha_{2,1}\text{academy} + \alpha_{2,2}\text{hsgpa} + \alpha_{2,i}\Sigma\text{demo} + \alpha_{2,i}\Sigma\text{hs}$
   where

   - entrance = a vector of variables measuring a student's entrance into the university

   and other variables are defined above.

The coefficient on career academy ($\alpha_{2,1}$) is a measure of the direct association between the academy and the student's probability of attending or enrolling in the university. The interpretation follows that outlined for Equation 1 estimation. This estimation also allows us to trace the *indirect* influence of the career academy on postsecondary education through high school GPA. If the career academy increases academic achievement in high school ($\alpha_{1,1} > 0$) and high school GPA increases the probability of entrance into college ($\alpha_{2,1} > 0$), the career academy indirectly increases the probability of postsecondary education by increasing high school GPA. We explicitly examine the direct and indirect (through GPA) influence of the academy in *all* outcomes in a summary of our results. For these analyses, we reestimate equations without including GPA on the right-hand side (e.g., $\alpha_{2,2} = 0$). Within this formulation, the coefficient on career academy captures both the direct (e.g., $\alpha_{2,1}$) and indirect impact through GPA (e.g., $\alpha_{1,1} \times \alpha_{2,1}$). The indirect impact is then measured by the difference between the coefficient estimates without GPA (total effect) and with GPA (direct effect).

Equation 2 is also used to examine the route that the student takes through the university by replacing the left-hand side of the equation with the need for remediation and transfer status. This modeling implicitly argues that the factors used to admit and enroll students are correlated with the route through the university. Because acceptance to and enrollment in the university, remediation, and transfer status are all binary variables, we use probit analysis for all estimations of Equation 2.

Finally, we assess the academy's influence on exit from college in terms of academic achievements in the university (GPA), dropping out, academic dismissal, and graduating. We initially model the student's academic achievement at the university so that subsequent analysis can examine the direct and indirect (through achievement in college) influence of the

[10] The probability of enrollment is conditioned on acceptance.

academy. We model academic achievement in college as a function of enrollment in a high school career academy, academic achievement in high school, individual demographics, high school of origin, and the route through college. Both needing remediation and transferring to the university, the constructs for route through college, are negative influences because students often use these mechanisms to acquire academic skills that could have been learned in high school. Thus:

3. $\text{collegegpa} = \alpha_{3,0} + \alpha_{3,1}\text{academy} + \alpha_{3,2}\text{hsgpa} + \alpha_{3,i}\Sigma\text{demo} + \alpha_{3,j}\Sigma\text{hs} + \alpha_{3,k}\Sigma\text{route}$
   where

   - collegegpa = the student's grade point average when leaving the university
   - route = a vector of variables designating a student's route through the university (remediation and transfer)

   and other variables are defined above.

The coefficient on career academy ($\alpha_{3,1}$) estimates its independent, direct influence on academic achievement at the university, and its interpretation follows that outlined above. The coefficient on the academic achievement in high school ($\alpha_{3,2}$) allows us to trace the indirect influence of a career academy on academic achievement in this university as outlined above. Since GPA is a relatively unbounded continuous measure, we estimate Equation 3 with OLS.

Our final model examines exit from college as a function of career academy enrollment, academic achievement in college, and individual demographics, such that

4. $\text{exit} = \alpha_{4,0} + \alpha_{4,1}\text{academy} + \alpha_{4,2}\text{collegegpa} + \alpha_{3,i}\Sigma\text{demo}$
   where

   - exit = a vector of variables indicating the type of exit from the university (dropping out, academic dismissal, and graduating)

   and other variables are defined above.

The career academy's influence on exit from college is modeled as both direct ($\alpha_{4,1}$) and indirect, through college GPA ($\alpha_{4,2} \neq 0$ assuming $\alpha_{3,1} \neq 0$). Our modeling suggests that neither high school nor route through college independently influences exit from college. Rather, these factors indirectly influence a student's exit from college through college GPA (Equation 3). Because each of these exit categories is a binary measure, we estimate these equations with a probit analysis.

Data

We draw our data from a medium-sized state university in California using all applicants to degree programs who had graduated from a single district's high schools between 1990 and 1997. This data set includes information on all of the district's graduates who (1) applied for admission, whether or not they completed the process; (2) were denied admission; (3) were admitted to the university but did not enroll; or (4) enrolled in the university. The data set contains information on individuals who had applied from 1990 through December 31, 1998, with data on university activities updated through Spring 1999.

In many ways, the university from which the data are drawn is typical of comprehensive, urban universities throughout the country. About 65% of the students reside within the county of the university's main campus, and another 19% reside in the county of its satellite campus. No demographic group is a majority. The university is in the middle tier of the California's system of higher education, which enrolls the top one-third of high school graduates in the state.[11] The three-tiered system in California was designed to allow mobility between tiers, especially from the community college system into the state university system. Students often come to a state university from the community college as juniors. Assuming that these students have maintained a passing grade point average, they are automatically admitted to the state university system.

The school district from which students matriculated is fairly typical of large, inner city, public school systems throughout the country. It services over 50,000 students in a core central city of a large metropolitan area and contains six comprehensive high schools.[12] Over 90% of the district's students are ethnic "minorities," over one-quarter have limited-English proficiency (LEP), nearly 40% receive free lunches, and the average daily attendance (percent days that a student came to school) is only slightly over 80%. Educational outcomes for the district's students are generally poor by most comparative, aggregate standards. In the 1994-1995 school year, the average GPA in academic courses in high school was below 2.00 in all but two high schools and did not exceed 2.35 in any grade or at any

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[11] Within this system, the University of California system of higher education contains the research universities, which enroll the top 12.5% of high school graduates. The California State University system (CSU), of which this university is a part, emphasizes undergraduate teaching and learning and enrolls the top third of high school graduates. The community college system enrolls all students with a high school diploma.

[12] A comprehensive high school is one in which a student can meet the academic requirements needed for enrollment in the University of California system.

high school. Yearly dropout rates stood at about 11%. SAT scores ranged from 633 to 872, with a district average of 784, well below the national average of 899. Yearly test scores in reading, language, and mathematics suggest that district students consistently fall near the bottom 25% of state test takers. Fewer than 25% of the district's graduates attended four-year colleges in California, and over 90% did not secure a degree from a postsecondary university or community college. Of those students who did attend a state university campus, freshman GPAs hovered around 2.00.

University records include nearly complete information on student demographics, year and high school of graduation, and type of application (i.e., transfer and first-time freshman). High school transcript information (GPA) is available for many applicants, although information is not always available for individuals who did not complete the application process or who transferred from community colleges.[13] For all students who enrolled in the university, information is available about the student's exit status,[14] their university GPA, and their major. We identified career academy students in this database with a listing of students from district records that was compiled as part of a mandated yearly evaluation of the program.[15]

This district has operated career academy programs since 1985 and currently houses 33 academies. Applicants to the university could have been in one of 12 career academies that were scattered across each of the six comprehensive high schools. The career academy model for this district includes both school-based and work-based components. The school-based learning component calls for students to take four academy classes per grade—three academic courses and a laboratory class—to be integrated through interrelated curricula and incorporation of material incorporated from and about the industry or profession. Students take these courses as a group starting in the 10th grade. The work-based learning component includes an internship for many of the academy students after their junior

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[13] By entering a CSU through the community college process outlined in the text, students need not provide information on their high school activities and the university obtains only information on the high school of origin from community college records. Achievement test data are available for only about one-half of the applicants.

[14] We define graduating as graduation, end of a program, or filed for graduation (allowable up to six months prior to expected graduation). We define dropping out as a break of enrollment of three or more quarters or an expiration of a leave of absence. We define changing program as not showing up for enrollment once admitted or changing program upon exiting from the university.

[15] The primary funder of the career academies from 1990-1998 stipulated a yearly evaluation of the academy students' performance against a set of benchmarks. Names, career academy of enrollment, semesters of enrollment, and basic demographic data on each student enrolled in a career academy were maintained as part of this evaluation.

year, job visits, and other opportunities to experience the work world and learn about the educational pathways to achievement of a skilled position.[16]

The district established policies for the career academies so that they would reflect a heterogeneous group of students from all levels of prior academic achievement and would avoid creaming only high achievers or, conversely, taking only those with academic problems. The district did not subscribe to the notion, often used in school-to-work programs elsewhere, that career academies should serve principally or exclusively "the forgotten half" of high school students, those deemed not college-bound. Although the programs achieved a reputation for increasing college attendance rates of the district's students, the outcomes from postsecondary education have not been examined.

[16]The academy model was not implemented with uniformity. Since the model was not fully implemented in all academies, its estimated coefficient understates the potential of the academy to increase postsecondary outcomes.

Results

Before we discuss the results of the multivariate estimations, we describe the characteristics of the university's students[17] and academy and nonacademy students from the district (Table 1). This description provides a basis for explaining the subsequent multivariate analysis, which highlights *changes* that the career academy imparts. The descriptive statistics show general differences between university students and those from the district in entrance into, route through, and exit from the university and in demographics and high school of origin. We see that students from this district bring lower GPA's from high schools than the average student in the university, although their need for remediation[18] is not necessarily higher. District students are less likely to be white and more likely to be African American than the student body as a whole, consistent with the characteristics of their students.

When we examine the applicant pool to the university, we see that career academy students disproportionately apply to this university. Although career academy students account for only about 19% of district students, they comprise 24.9% of the district's applicants and 24.2% of those district students who are accepted to admission. Of course, several explanations might account for this relatively large percentage of applicants to the local university. The career academy program model was designed to increase education and establish clear pathways to facilitate postsecondary education, presumably to the local university. Both elements would increase application to the local university by increasing education of students who might not otherwise continue past high school. Alternatively, the career academy, with well-articulated educational pathways to the local university, might funnel applicants away from a broader range of universities. Of note, the percentage of applicants from academies who were accepted to the university is lower than the percentage of nonacademy students, even though no significant difference exists in high school GPA.

Once at the university, achievements are not great for either academy or nonacademy students from this district (Table 1). About half of both groups who enrolled in the university ultimately graduated and over one-third of both groups dropped out. Career academy students left college with a lower GPA than nonacademy students, even though the declared majors between the two groups were similar (results not shown here). The route through

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[17] Although the university awards masters degrees, 75.8% of the students at the university are undergraduates.

[18] Remediation rates for district students are not directly comparable to those of the university students because they include transfer students and rate for university is for first quarter freshmen.

Table 1. Characteristic Differences Between Academy and Nonacademy Students in Four-Year Universities

	University Students	All Applicants		Accepted		Enrolled	
		Non-academy	*Academy*	*Non-academy*	*Academy*	*Non-academy*	*Academy*
% Academy Students		24.9		24.2		20.5	
Entrance							
% Accepted	—	79.0	75.9	100	100	100	100
% Enrolled (of those accepted)	—	—	—	81.4	66.4**	100	100
High School GPA	3.24	2.88	2.93	2.93	2.99	2.87	2.89
Outcome[1]							
College GPA	—	—	—	—	—	2.24	2.02**
% Graduated	43.3 (first quarter freshmen)	—	—	—	—	55.3	55.1
% Dropped Out	—	—	—	—	—	36.7	37.1
% Dismissed	—	—	—	—	—	6.0	5.4
Route to College[2]							
% Transfer Students	27.7	18.7	14.3**	18.1	11.7**	20.3	13.8**
% English Remediation	55.0	63.5	68.8	55.3	61.1	47.1	46.7
% Math Remediation	58.0	62.3	75.0**	54.0	69.7**	48.4	59.3**
Demographics[3]							
% Male	36.0	29.1	27.5	28.5	24.5	29.4	25.1
% African American	14.1	40.1	52.4**	37.5	52.5**	40.8	57.5**
% Asian	30.1	40.6	31.2**	43.9	30.2**	42.2	26.3**
% Latino	12.5	15.0	14.3**	14.4	15.1	12.9	14.4
% White	38.5	2.8	2.0	2.9	2.3	2.8	1.8
School[4]							
% A	0.4	1.5	10.6**	1.4	10.6**	1.8	12.6**
% B	0.8	7.7	13.2**	8.3	15.5**	10.0	20.4**
% C	2.0	10.4	21.2**	10.6	22.3**	11.6	22.8**
% D	1.3	10.4	31.8**	10.3	29.1**	10.0	29.3**
% E	3.6	38.3	8.9**	37.6	9.4**	34.2	5.4**
% F	2.7	30.8	14.3**	30.8	13.2**	31.4	9.6**
N	12,855	1,053	349	832	265	649	167

Sample: University students are those enrolled in Fall 1997. Former district students are those who applied to the local four-year university for a degree program with a reported high school grade point average. Enrolled students also must have a college GPA to be included.
Note: Numbers are means. Asterisks represents a significant difference between academy and nonacademy students (**$p \leq .05$).
[1] The remaining category for exiting college is "changed mind."
[2] Remediation can be bypassed with community college courses. Remediation rates for the university students are for first-quarter freshman. Transfer rates for the university as a whole are computed as students who transferred into the university during Fall 1997. Students who transferred to the university during previous quarters are not counted as transfer students.
[3] Less than two percent of the district's sample are from "other" demographic groups.
[4] High schools are listed from the lowest socioeconomic service area (A) to the highest (F). Less than one percent of the sample came from noncomprehensive high schools. For the university as a whole, the percentage distribution is shown for first-time freshmen.

college also differed between academy and nonacademy students. A greater proportion of career academy students were first-time freshmen (not transfer students), which may account for the increased proportion needing

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math remediation since community college enrollment is often used to fulfill remediation needs.

Statistically significant differences exist between the demographics and the high school of origin of academy and nonacademy students. Academy students are more likely to be African American and less likely to be Asian than nonacademy students, and a greater proportion of career academy students were from district schools drawing from lower socioeconomic status service areas. Both demographics and high school differences reflect building of career academies in high schools that are disproportionately African American and that draw from the lowest socioeconomic service areas. Because both demographic and school differences suggest that students from academies have lower socioeconomic backgrounds than students not from academies, career academy students might face greater difficulty in postsecondary education than their nonacademy counterpart.

Entering the University

The descriptive statistics presented in Table 1 suggest that, as compared with nonacademy students, career academy students entered the university (1) with equivalent academic achievement in high school (high school GPA), (2) with a lower socioeconomic status background, (3) with a disproportionately higher proportion applying to the university, and (4) with a lower percentage of those accepted to the university.

Our multivariate estimations of Equations 1 and 2 suggest that these findings may be interrelated such that the career academy has a positive influence on academic achievement in high school, once we control for demographics and high school (Table 2). If career academy students do face hardships in school because of their lower socioeconomic status background, the insignificant difference in high school GPA (Table 1) may stem from the disproportionate percentage of career academy students from groups with lower GPAs.[19] Once these differences are controlled for in multivariate estimations, we see that the career academy has a positive influence on academic achievement in high school, ceteris paribus. In fact, the descriptive statistics and multivariate results together suggest that the career academies may take more disadvantaged students and raise their academic achievement in high school.

The positive influence of the career academy on academic achievement in high school produces an *indirect* influence that increases acceptance to this university (Table 2). That is, an increased GPA in high school increases the probability of being accepted into the university, which offsets some of the negative influence on acceptance and enrollment, all else equal. As will

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[19] The furor about lower GPAs of African American students in this district is a widely known local issue that, at times, has attracted national attention.

Table 2. The Career Academy's Influence on Entrance into the University: Multivariate Coefficients

	HS GPA	Accepted	Enrolled
Academy	.113**	-.189*	-.654**
	(.031)	(.099)	(.112)
HS GPA	—	.644**	-.638**
		(.089)	(.103)
Demographics			
Male	-.119**	-.107	.178
	(.027)	(.086)	(.102)
African American[1]	-.374**	.001	-.109
	(.066)	(.217)	(.239)
Asian	.025	.203	.055
	(.067)	(.220)	(.235)
Latino	-.088	-.062	-.236
	(.071)	(.231)	(.250)
School[2]			
A	-.054	.069	.603**
	(.069)	(.212)	(.278)
B	.022	.454**	.793**
	(.048)	(.164)	(.203)
C	.001	.097	.398**
	(.042)	(.137)	(.159)
D	-.002	-.140	.143
	(.040)	(.126)	(.146)
E	.014	-.173	-.112
	(.034)	(.109)	(.121)
Mean (dependent variable)	2.89	.783	.777
Intercept	3.06	-1.00	2.75
R^2	.152	—	—
N	1,402	1,402	1,098

Sample: Former district students who applied to the local four-year university for a degree program and had a reported high school grade point average and race/ethnicity. Enrolled students also must have a college GPA to be included.
Note: Coefficients on the Accepted and Enrolled equations were obtained from probit analysis. Coefficients on the high school grade point average (HS GPA) equation were obtained from ordinary least squares regression. Standard errors are in parentheses.
[1]White and other are the omitted categories on the race/ethnicity binaries.
[2]High school F, which draws students from the highest socioeconomic service area, is the omitted category on the school binaries.
** $p \leq .05$

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be discussed later, the overall influence is negative for both acceptance and enrollment. The cause for this cannot be discerned with our data but deserves further research attention. An optimistic interpretation of this result might argue that career academy students who are accepted to this particular university might have other, more attractive alternatives that they pursue, as does the student with the higher GPA, which also has a negative association with enrollment.

Route Through the University

Estimation of the route through the university (Equation 2) suggests that the career academy directly reduces the need for remediation in English and indirectly decreases the need for remediation in math by raising high school GPA (Table 3). Within the multivariate estimations, the career academy has an independent influence only on reducing the probability of needing remediation in English and not on the probability of needing remediation in math or in transferring to the university. The career academy has an independent, negative impact on the need for math and English remediation by raising high school GPA (Table 2), which in turn lowers the need for remediation at the university (Table 3). However, this indirect impact does not affect transferring to the university.

While the academy's impact on reducing need for remediation is encouraging, it must be noted that the rates of remediation are extremely high for students from this district (Table 4). *Over one half of academy applicants and 40% of nonacademy applicants need both math and English remediation before taking university-level course work.* Less than one-third of all nonacademy students and of one-fourth career academy students do not need any remediation. Thus, even though the career academy lowers the marginal probability of needing remediation, both directly and indirectly in the case of English, 70% of the applicants to this university need some type of remediation before starting university-level coursework.[20] Of course, this lack of preparation for college-level coursework dramatically increases the out-of-pocket and time costs of completing a baccalaureate degree and should serve as a warning to administrators in high schools that current programs are not successful from the vantage point of the four-year university.

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[20]Of course, the high rates of remediation and the relatively high GPA in high school (mean 2.89) suggest that the absolute measure of GPA is not a good indication of readiness for college. There is no indication, however, that it is not a good relative measure of academic achievement for comparing academy and nonacademy students.

Table 3. The Career Academy's Influence on the Route Through the University: Multivariate Coefficients

	Needs English Remediation	Needs Math Remediation	Transfer Student
Academy	-.284**	.050	-.091
	(.127)	(.133)	(.153)
HS GPA	-.233**	-.650**	.046
	(.106)	(.116)	(.125)
Demographics			
Male	-.120	-.235**	.173
	(.103)	(.108)	(.115)
African American[1]	1.06**	.377	-.271
	(.331)	(.264)	(.271)
Asian	.719**	-.548**	-.190
	(.329)	(.263)	(.265)
Latino	1.196**	.203	-.671**
	(.343)	(.281)	(.303)
School[2]			
A	1.367**	1.272**	-1.05**
	(.296)	(.370)	(.457)
B	.469**	.253	-.281
	(.165)	(.171)	(.198)
C	.440**	.483**	-.377
	(.156)	(.163)	(.192)
D	.363**	.162	-.058
	(.156)	(.164)	(.176)
E	.386**	.336**	.011
	(.129)	(.136)	(.140)
Mean (dependent variable)	.471	.506	.190
Intercept	-.560	1.71	-.666
N	816	816	816

Sample: All individuals who were enrolled in the university and had a reported high school GPA, race/ethnicity, and a college GPA.
Note: All coefficients were obtained from probit estimations. Standard errors are in parentheses.
[1]White and other are the omitted categories on the race/ethnicity binaries.
[2]High school F, which draws students from the highest socioeconomic service area, is the omitted category on the school binaries.
** $p \leq .05$

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Table 4. Need for Remediation: Descriptive Statistics

	Total	Nonacademy	Academy
% Needing no remediation	30.5	32.6	23.9
% Needing both math and English remediation	45.0	41.8	54.9
% Needing only English remediation	11.8	13.5	6.4
% Needing only math remediation	12.8	12.1	14.8
N	1,098	834	264

Sample: All individuals who enrolled in the university and had a reported high school GPA and race/ethnicity.
Note: Numbers are percentage of students that fall into each category.

Postsecondary Outcomes

Although the descriptive statistics presented in Table 1 suggest that career academy and nonacademy students differ only in GPA in college, multivariate estimations of Equations 3 and 4 suggest that the career academy has a direct influence on increasing graduation from the university. It does not have a significant influence on college GPA, dropping out, or academic dismissal (Table 5). These results suggest that once all else is equal, most probably the lower socioeconomic status of academy students, the career academy has a positive influence on outcomes from college by increasing the probability of graduating.

However, the academy does exert an indirect influence on college GPA through academic achievement in high school. Still, even with these positive influences, the postsecondary outcomes of students from this district are not good. The average GPA upon exit is 2.19, only slightly higher than the 2.00 needed for graduation and far lower than the average needed for post-graduate study. Over one-third of the district's students drop out of college, and only about one-half graduate. Six percent leave because of academic failure. Within this context, the marginal impact of the career academy to facilitate postsecondary outcomes above those of nonacademy students must be extremely large to ensure students' success in postsecondary education.

Academy's Influence

The multivariate estimations suggest that the academies have a direct and indirect influence on a student's entrance into, route through, and exit from the university. The descriptive statistics sprinkled throughout the paper suggest that educational outcomes for students from this district are generally poor. High rates of remediation, low college-level GPA, and high

Table 5. The Career Academy's Influence on Exit from Postsecondary Education: Multivariate Coefficients

	College GPA	Dropped Out	Dismissed	Graduation
Academy	-.121	-.204	-.212	.267**
	(.067)	(.122)	(.203)	(.127)
College GPA	—	-.689**	-.723**	1.01**
		(.067)	(.104)	(.078)
HS GPA	.476**	—	—	—
	(.057)			
Route through College				
English Remediation	-.238**	—	—	—
	(.057)			
Math Remediation	-.320**	—	—	—
	(.060)			
Transfer Student	.036	—	—	—
	(.066)			
Demographics				
Male	-.044	-.008	.129	.024
	(.055)	(.110)	(.178)	(.112)
African American[1]	-.354**	-.332	.048	.616**
	(.141)	(.264)	(.532)	(.273)
Asian	-.084	-.655**	.155	.800**
	(.139)	(.261)	(.535)	(.267)
Latino	-.126	-.451	-.231	.759**
	(.150)	(.281)	(.581)	(.290)
School[2]				
A	-.168	—	—	—
	(.140)			
B	-.042	—	—	—
	(.090)			
C	-.135	—	—	—
	(.084)			
D	.053	—	—	—
	(.084)			
E	.019	—	—	—
	(.069)			
Mean (dependent variable)	2.19	.368	.059	.553
Intercept	1.36	1.63	-.305	-2.84
R^2	.322	—	—	—
N	816	816	816	816

Sample: All individuals who were enrolled in the university and had a recorded high school and college GPA and race/ethnicity. All individuals had left the university at the time of data extraction.

Note: All coefficients were obtained from probit estimations, except College GPA (OLS). Standard errors are in parentheses.

[1]White and other are the omitted categories on the race/ethnicity binaries.

[2]High school F, which draws students from the highest socioeconomic service area, is the omitted category on the school binaries.

** $p \leq .05$

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dropout rates from the university all suggest that the career academy's influence must be great to ensure postsecondary success of its students. We examine the magnitude of the career academy's influence to determine whether this is the case. In this analysis, we computed the direct influence of the career academy as measured by the coefficients in Equations 1 through 4. For ease in interpretation, we converted all probit coefficients to marginal probabilities using the z-score computed from these estimations. We compare changes that the career academy imparts by simulating the outcomes modeled in Equations 1 through 4 for nonacademy students using the estimated coefficients, mean values on the independent variables, and zero on the academy variable. The total influence of the career academy—the direct effect and indirect effect—is estimated with coefficients from Equations 1 through 4 with GPA (high school or college) omitted from the right-hand side. The indirect effect, through GPA, is computed as the residual once the direct effect is subtracted from the total effect. This analysis is shown in Table 6.

We see that, although the total effect of the career academy on most outcomes was relatively small, it reduced the probability of enrolling in the university by .224. Of course, this could be a positive outcome *if* career academy students are not enrolling in this university because they have better opportunities. The career academy also had a relatively large impact on reducing the need for remediation in English. In fact, simulations suggest that the career academy decreased the need for English remediation by approximately 12 percentage points, lowering the need for remediation to about 40%. Being in a career academy also increased the probability of graduating by 4.3 percentage points, raising the simulated probability to nearly .6, and dropping out by 3.7 percentage points. Career academy enrollment exerted a relatively small impact on other outcomes.[21]

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[21] There are, of course, numerous sampling issues that could influence these estimations. Appendix B provides a full discussion.

Table 6. A Summary of the Career Academy's Influence

	Simulated Value for Nonacademy Students	Direct Effect of Career Academy	Indirect Effect Through HS GPA	Indirect Effect Through College GPA	Total Effect of Career Academy
High School GPA	2.86	.113	—	—	.113
Probability of Being Accepted	.810	-.056	.023	—	-.033
Probability of Enrolling	.848	-.204	-.020	—	-.224
Probability of Needing English Remediation	.492	-.114	-.007	—	-.121
Probability of Needing Math Remediation	.508	.020	-.024	—	-.004
Probability of Transferring	.184	-.023	-.000	—	-.023
College GPA	2.23	-.121	.043	—	-.078
Probability of Dropping Out	.367	-.076	—	.039	-.037
Probability of Being Dismissed	.036	-.014	—	.001	-.013
Probability of Graduation	.528	.101	—	-.058	.043

Notes: Numbers were estimated using coefficients presented in Tables 2, 3, and 5. Probabilities were computed from probit estimations by converting estimations to z-scores. The first column of numbers represents the value of the activity for students who did not attend a career academy. The remaining columns represent the change, from the nonacademy students, that the academy imparts. The second column of numbers represents the direct impact of being in an academy, as specified in the text equations with probit estimations converted to marginal probabilities at the mean. The final column of numbers is the total influence of being in the academy (i.e., both direct and indirect effect) as measured by the estimation of text equations without GPA (high school or college) included on the right-hand side. The third and fourth columns of numbers are the indirect effects, which are computed as the residual after the direct effect is subtracted from the total effect.

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Summary and Discussion

Our unique data set yields important insights into the postsecondary activities of students from one type of school-to-work program, the high school career academy. Results suggest that the career academy raises academic achievement in high school (as measured by GPA), decreases the need for remediation in English at the university, and increases the probability of graduating from the university for a group of students who are not likely to attend a university. This is no small feat, and these positive results should not be discounted. To expect educational reform efforts to cure all ills within a decade after implementation is unrealistic. Marginal improvements must be made and the career academies have improved outcomes from high school and in postsecondary education.

Nonetheless, the career academy advantages may not be strong enough to compensate for the poor educational outcomes for students from this district. Over 70% of applicants from the district needed either English or math remediation, and over 40% needed both. Less than 60% of students who enroll actually graduate. College GPA at the time of exit is only slightly above the 2.00 mark.

Thus, while career academies should be lauded for their accomplishments, their influence cannot fully overcome the disadvantages that students from inner city public high schools face in the university. If career academies are to win the war for educational success for all students, they cannot rest on laurels, proclaiming their success at reducing high school dropout rates and building skills among high school students. Results of this study suggest that they have not yet provided all their students with the knowledge and skills necessary to succeed in postsecondary education. Reducing high school dropout rates may be a necessary condition for improving education, but it is not sufficient to ensure success after high school.

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Appendices

Appendix A

Table A1. Definition of Variables

Variable	Definition
Entrance	
Accepted	A (0, 1) binary variable with 1 indicating that the individual was accepted into the university.
Enrolled	A (0, 1) binary variable with 1 indicating that the individual who was accepted into the university actually enrolled.
High School GPA (HSGPA)	The individual's grade point average in high school. For students who had a missing grade point average but had achievement test scores (SAT or ACT), the GPA was predicted from an equation of individuals with GPAs using the achievement score as the independent variable.
Academy	A (0, 1) binary variable with 1 indicating that the individual was enrolled in a career academy in high school.
Exit	
College GPA	The individual's grade point average at the time of leaving the university.
Graduated	A (0, 1) binary variable with 1 indicating that the individual graduated from the university.
Dropped Out	A (0, 1) binary variable with 1 indicating that the individual dropped out of the university.
Dismissed	A (0, 1) binary variable with 1 indicating that the individual was dismissed from the university for academic reasons.
Route (through College)	
Transfer Students	A (0, 1) binary variable with 1 indicating that the individual transferred into the university from another postsecondary institution.
English Remediation	A (0, 1) binary variable with 1 indicating that the individual had to take remediation courses in English before beginning college-level English courses. An individual could be exempt from remediation by passing a course at a community college.
Math Remediation	A (0, 1) binary variable with 1 indicating that the individual had to take remediation courses in math before beginning college-level math courses. An individual could be exempt from remediation by passing a course at a community college.
Demographics (Demo)	
Male	A (0, 1) binary variable with 1 indicating that the individual was male.
African American	A (0, 1) binary variable with 1 indicating that the individual was African American.
Asian	A (0, 1) binary variable with 1 indicating that the individual was Asian.
Latino	A (0, 1) binary variable with 1 indicating that the individual was Latino.
White	A (0, 1) binary variable with 1 indicating that the individual was White.
School (HS)	
A	A (0, 1) binary variable with 1 indicating that the individual attended the school with the lowest socioeconomic attendance area.
B	A (0, 1) binary variable with 1 indicating that the individual attended the school with the second lowest socioeconomic attendance area.
C	A (0, 1) binary variable with 1 indicating that the individual attended the school with the third lowest socioeconomic attendance area.
D	A (0, 1) binary variable with 1 indicating that the individual attended the school with the third highest socioeconomic attendance area.
E	A (0, 1) binary variable with 1 indicating that the individual attended the school with the second highest socioeconomic attendance area.
F	A (0, 1) binary variable with 1 indicating that the individual attended the school with the highest socioeconomic attendance area.

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Appendix B

Should the critic desire to find fault with this study, numerous avenues could be pursued.

- The study draws data from students in one high school district who are at one university.
- The career academy programs that developed in this district may not represent career academies in other districts.
- Career academy programs were at different stages of program implementation.
- The outcomes from career academy students may not reflect program impacts because students were not randomly assigned to the program.
- Nonacademy students may not reflect a true population of nonacademy students because they were schooled in a district that grounded its educational reform in school-to-work efforts.
- The university to which these students applied may not be representative of urban, comprehensive universities.
- The selection of students who applied to and were accepted into this university—as opposed to other universities—is not random and may vary by academy status.

The list of potential criticisms is virtually unbounded. We cannot begin to address all potential concerns in external validity, at least in areas that are observable. We can only examine the potential biases that might exist and note that the data afforded by a study of this kind present research possibilities beyond the scope of those undertaken under more stringent research conditions.

We can, however, examine potential biases that might arise from internal validity. How does the sample that we analyze compare to typical high school seniors from this district and students who were omitted from the analysis because of missing data? Appendix Table B1 shows that, as compared to the population of seniors in the district, our samples ("All Applicants with HS GPA") contains a greater proportion of students from academies and a relatively higher socioeconomic school (high school E) and with higher high school GPAs as well as fewer males and more Asians. Fewer of the university's students who were omitted from our analysis were academy students and were accepted to the university, suggesting that our analysis omitted weaker students. This supposition gains strength with the statistics showing that virtually all (90%) of the students who were omitted were transfer students without high school GPA data. These students were most likely those who gained admission to the university by completing lower division general education and remediation

requirements at a community college. Of note, Asian students disproportionately took this route through college as did students from schools with higher socioeconomic service areas.

Thus, it appears that our analysis systematically excludes one important route through the university—completing lower division coursework and remediation at a community college and transferring to a four-year university. Because this route was *the* route designed in California's master plan for moving high school students with weak academic skills into the four-year university, further research should examine the impact of career academy programs on this route through college. Because statistics in Appendix Table B1 suggest that students omitted from our analysis had higher graduation rates and college GPAs than students in our analysis, the community college may be a more attractive alternative to students from this district than directly entering the four-year university. If this is the case, the negative influence of the career academy on acceptance and enrollment that was shown in Table 2 might arise because the "wrong" route was selected; a more positive outcome might occur if they first enrolled in a community college.

Still, despite the caveats in this research, the access to data that follows students between secondary and postsecondary education affords invaluable insights into program evaluation. This study therefore provides a stepping stone toward learning about the influence of high school reform efforts like the career academy on postsecondary educational activities.

Table B1. A Cursory Examination of Sample Selection: Characteristics of Former Students Not Included in the Analysis

	District High School Seniors[1]			University Applicants			
	All District Students	Non-academy Students	All Academy Students	All Applicants with HSGPA[4]	Applicants missing HSGPA	Accepted missing HSGPA	Enrolled missing HSGPA
% Academy	19.3	—	—	24.9	14.2	5.4	4.1
Entrance							
% Accepted	—	—	—	78.2	53.7	100	100
% Enrolled	—	—	—	77.7	84.7	84.2	100
High School GPA	2.32	2.29	2.45	2.89	—	—	—
Outcome							
College GPA	—	—	—	—	—	—	2.47
% Graduated	—	—	—	—	—	—	72.2
% Dropped Out	—	—	—	—	—	—	21.3
% Dismissed	—	—	—	—	—	—	4.1
Route to College							
% Transfer Students	—	—	—	17.6	70.9	98.0	98.2
% English Remediation	—	—	—	64.8	47.8	5.4	4.7
% Math Remediation	—	—	—	65.5	50.7	7.9	7.7
Demographics[2]							
% Male	48.3	49.5	43.2	28.7	36.1	35.5	33.7
% African American	48.7	46.9	56.1	43.2	36.4	17.7	15.4
% Asian	27.7	29.1	21.9	38.3	46.1	67.5	69.8
% Latino	15.7	16.0	14.5	14.8	12.6	8.4	8.3
% White	5.7	5.8	5.4	2.6	2.9	3.9	4.1
School[3]							
% A	4.5	1.6	16.4	3.8	3.2	1.0	1.2
% B	10.5	8.8	17.5	9.1	5.2	2.5	1.8
% C	20.7	21.9	15.5	13.1	9.5	7.9	7.7
% D	12.7	8.4	30.7	15.8	11.2	11.3	10.1
% E	24.2	28.3	7.0	31.0	39.3	46.3	47.3
% F	27.5	30.9	12.9	26.7	30.6	31.0	32.0
N	5,952	4,805	1,147	1,402	402	203	169

[1]The district sample contains the population of students who were sophomores in one of the six comprehensive high schools from 1990-1993 and who were still in a comprehensive high school three years later, presumably when they were seniors. Data are computed at the time the student left school.

[2]An additional 26 applicants, 18 of whom accepted and 17 of whom enrolled, had a high school GPA reported but did not have a race or ethnicity reported.

[3] High schools are listed from the lowest socioeconomic service area (A) to the highest (F). Less than one percent of the sample came from noncomprehensive high schools.

[4]All applicants with a recorded high school GPA (HS GPA) and race/ethnicity are used in our analysis.

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